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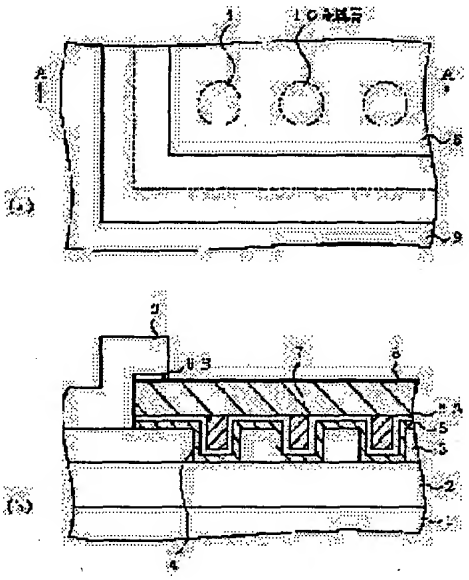
(54) SEMICONDUCTOR DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an electrode pad where aluminum is not stripped by contacting a bottom of the electrode pad to a metal layer in a groove formed on an insulation film.
SOLUTION: A semiconductor device comprises an oxidation film 3 of about 1 μm thickness which is formed on a semiconductor substrate 1, a groove 4 of 0.8 μm diameter which is formed on the oxidation film 3, Ti film 5 of about 30 nm thickness formed on the film 3 containing the groove 4, TiN film 6A of about 100 μm thickness, W film 7 imbedded in the groove 4, and electrode pad comprising Al alloy film 8 of about 600 nm thickness formed on the W film 7 and TiN film 6A. As a usut since the electrode pad is connected to be metal layer 10 formed in the groove 4 including the W film 7 and others, aluminum of the pad is not stripped even if wire bonding is achieved.



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CLAIMS

[Claim(s)]
[Claim 1] It is the semiconductor device characterized by connecting with the metal layer of Mizouchi by whom the inferior surface of tongue of the aforementioned electrode pad was formed in the aforementioned insulator layer in the semiconductor device which has the electrode pad formed through the insulator layer on the semiconductor substrate.
[Claim 2] Mizouchi's metal layer is a semiconductor device according to claim 1 which consists of a refractory metal.
[Claim 3] Mizouchi's metal layer is the same semiconductor device according to claim 1 as the metal layer embedded in a beer hall.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] Especially this invention relates to the structure of the electrode pad of a semiconductor device about a semiconductor device.
[0002]
[Description of the Prior Art] In order to connect a semiconductor chip and the internal lead of a leadframe with a wire, generally on the semiconductor chip, the electrode pad is formed in one with wiring. The structure of the electrode pad of the conventional semiconductor chip is explained using drawing 2 .
[0003] Drawing 2 (a) and (b) are the conventional plans and B-B line cross sections of an electrode pad.
[0004] This electrode pad is formed from the lamination film of the boron phosphorus glass (BPSG) film 2 and oxide film 3 by which were formed on the semiconductor substrate 1 and flattening was carried out, the titanium (Ti) film 5 formed on this, titanium-nitride (TiN) film 6A, and (Aluminum aluminum) alloy film 8 as shown in drawing 2 (a) and (b). Here, the reason for laminating is for aiming at improvement in reliability with detailed-izing of aluminum wiring, and the laminating of the TiN film for raising Ti film and adhesion as a barrier metal has indispensable structure.
[0005] However, at this laminated structure, an ultra-thin titanium oxide compound is easy to be generated by the interface of the Ti film 5 and an oxide film 3. A titanium oxide compound is weak and tends to produce peeling in the interface of the plasma oxidation film 3 and the Ti film 5 with the stress at the time of carrying out wirebonding to an electrode pad. In addition, the stress in the case of bonding tends to produce peeling, so that the thickness of aluminum alloy film 8 becomes thin, since it becomes so large that aluminum alloy film becomes thin.
[0006] In recent years, in the semiconductor chip, aluminum wiring width of face is small further with large-capacity-izing, and aluminum wiring thickness has been thin-film-ized in connection with it. Therefore, an electrode pad is also thin-film-ized and the danger of peeling at the time of bonding can be said [increasing increasingly in recent years and].
[0007] In addition, a substrate front face is made into a split face, a solder layer is prepared in JP,60-227483,A, and the method of raising the adhesion of a solder layer and a substrate is proposed. However, only by making the front face of an oxide film 3 into a split face, the stress at the time of bonding inclines and degradation of the peeling (henceforth aluminum peeling) resistance of aluminum alloy film from the part is predicted. Moreover, if the spatter of the aluminum alloy is carried out to a split face, since aluminum alloy film will be formed by uniform thickness, if the front face of aluminum alloy film also turns into a split face and carries out bonding in this state, the problem that become a partial eutectic alloy and the stable bonding junction is not obtained will also be produced.
[0008]
[Problem(s) to be Solved by the Invention] The supersonic oscillation impressed at the time of bonding produces aluminum peeling at the time of bonding by being added locally.
[0009] Moreover, this fault has the dominant brittleness of the interface of Ti film produced by

laminating aluminum alloy film, and an oxide film.
[0010] Although it is tended to absorb the stress by supersonic oscillation aluminum alloy film and it does not pose especially a problem conventionally when the thickness of aluminum alloy film is as large as 1 micrometers or more, by thin film-ization of aluminum alloy film in recent years, the stress of supersonic oscillation tended to get across to the interface of Ti film and an oxide film, and this fault has actualized.
[0011] Moreover, reduction-ization of the bonding ball by reduction-izing of an electrode pad is also the acceleration factor of this fault in respect of local impression of supersonic oscillation.
[0012] In addition, this fault will produce ablation in the interface of Ti film and an oxide film, even when not producing aluminum peeling, and it will be easy to cause the fall of a bonding bonding strength, and the reliability over commercial-scene environmental stress will fall.
[0013] The purpose of this invention solves a trouble which carried out point **, and is to offer a semiconductor device with the high reliability which has the electrode pad which does not produce aluminum peeling.
[0014]
[Means for Solving the Problem] In the semiconductor device which has the electrode pad with which the semiconductor device of this invention was formed through the insulator layer on the semiconductor substrate, the inferior surface of tongue of the aforementioned electrode pad is characterized by connecting with Mizouchi's metal layer formed in the aforementioned insulator layer, and makes a refractory metal the metal layer embedded especially at Mizouchi.
[0015]
[Function] Therefore, by forming a metal layer in the lower layer oxide film of an electrode pad partially, ablation of Ti film by the stress at the time of the supersonic oscillation at the time of bonding and an oxide film can be suppressed, and aluminum peeling at the time of bonding can be prevented. This effect is acquired by the configuration and bird clapper by which Ti film which touches an oxide film was embedded at the oxide film by forming a metal layer in the lower layer oxide film of an electrode pad partially.
[0016] This is for making ablation of the Ti film and the oxide film which are produced horizontally suppress by forming vertical Ti film to the horizontal stress at the time of supersonic oscillation. In addition, since Ti film is embedded at the oxide film, horizontal intensity is improving.
[0017]
[Embodiments of the Invention] Next, this invention is explained with reference to a drawing. Drawing 1 (a) and (b) are the plans and A-A line cross sections near the electrode pad for explaining the gestalt of operation of this invention.
[0018] When drawing 1 (a) and (b) are referred to, the semiconductor device of this invention The oxide film 3 with a thickness of about 1 micrometer formed on the semiconductor substrate 1, and the slot 4 with a diameter of 0.8 micrometers established in this oxide film 3, It has the electrode pad which consists of the Ti film 5 with a thickness of about 30nm formed on the oxide film 3 including this slot 4, with a thickness of about 100 micrometers TiN film 6A, a W film 7 embedded in the slot 4, and this W film 7 and aluminum alloy film 8 with a thickness of about 600nm formed on TiN film 6A. In addition, in drawing 1 (b), 6B is a TiN film for acid resisting, and a passivation film with which 9 consists of a PSG etc.
[0019] Thus, according to the gestalt of this constituted operation, since it connects with the metal layer 10 of the W film 7 grade formed in the slot 4, an electrode pad does not produce peeling, even when carrying out bonding of the wire.
[0020] Next, the manufacture method of the gestalt this operation is explained in detail with reference to a drawing.
[0021] In the electrode pad shown in drawing 1 (a) and (b), the diameter of about 0.8 micrometer and the metal layer 10 with a depth of about 1 micrometer are partially formed in a ground oxide-film layer. At this time, it consists of a W film 7 embedded [film / Ti / 5] in about 100nm and the cavernous section of a slot 4 in about 30nm and TiN film 6A as a metal layer 10, and these are formed of a spatter or CVD. And about 600nm of aluminum alloy films 8 is formed on the above-mentioned partial metal layer, and an electrode pad is formed.

[0022] The formation of a partial metal layer 10 like this structure is as follows. After formation of the BPSG film 2 and oxide film 3 which are a ground interlayer film first, after forming a slot 4 by patterning and dry etching, the Ti film 5 and TiN film 6A are formed.
[0023] Next, the W film 7 is formed and etchback of the W films 7 other than a slot is carried out. Then, the spatter of the aluminum alloy is carried out and an electrode pad is formed in one with aluminum wiring patterning and by **********ing.
[0024] In addition, the semiconductor chip in recent years is multilayer-interconnection-ized, and since formation of the partial metal layer of the gestalt of this operation can be performed simultaneously with the beer hall formation for junction during vertical wiring, it is not accompanied by the increase in the number of processes. W, Mo, etc. same as a metal embedded in **** 4 as the metal buried in a beer hall are used.
[0025] Locally, at right angles to a ground oxide-film layer, the electrode pad of the above-mentioned structure forms the Ti film 5 which is easy to produce interfacial peeling so that it may spike. Therefore, while expanding the interface of the Ti film 5 and an oxide-film layer, it has firm and advantageous structure to the stress of the supersonic oscillation at the time of bonding.
[0026] Since the perpendicular Ti film 5 exists to supersonic oscillation being added horizontally, this is for exfoliation not to arise. Moreover, even if the metal layer 10 embedded at the oxide film 3 produces very small exfoliation of the Ti film 5 and an oxide film 3 by being fixed by the oxide film of the side, aluminum alloy film 8 does not separate.
[0027] In addition, although the cross-section configuration of a slot 4 was explained as a circle, it is not limited to this and, of course in the form of the above-mentioned implementation, you may be a square etc.
[0028]
[Effect of the Invention] As point ** was carried out, this invention serves as a configuration which the titanium film which is the lowest layer of an electrode pad embedded in the ground oxide-film layer, and since the side of the metal layer embedded locally is being fixed by the oxide film, the electrode pad has firm structure to the supersonic oscillation at the time of wirebonding.
[0029] Therefore, when carrying out bonding to an electrode pad, the bond strength by which it was hard coming for interfacial peeling of Ti film and an oxide film to be generated, and it was stabilized is obtained. It is effective in the semiconductor device which has high reliability for this reason being obtained.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The plan and cross section near the electrode pad for explaining the gestalt of operation of this invention.
[Drawing 2] The plan and cross section for explaining the conventional electrode pad.
[Description of Notations]
1 Semiconductor Substrate
2 BPSG Film
3 Oxide Film
4 Slot
5 Ti Film
6A, 6B TiN film
7 W Film
8 Aluminum Alloy Film
9 Passivation Film

[Translation done.]